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A Revision of the Bees of the Subgenus *Epinomia* in the New World (Hymenoptera-Halictidae)*

BY

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ABSTRACT. This is the first of two papers dealing with the systematics and geographical variation of the New World members of the subgenus *Epinomia* Ashmead. It contains a revision of the subgenus and includes information on distribution, geographical variation, and flower preferences of its species. About 1500 specimens were examined.

Indications of the relationships between the subgenera of *Nomia* and a subgeneric key are presented.

Four species are recognized, one of which (*N. nevadensis*) is further divided into five subspecies. A more detailed study of the geographical variation of this species will be published elsewhere. Two species, *N. boharti* and *N. micheneri*, and one subspecies, *N. nevadensis stellata*, are described as new.

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INTRODUCTION

The purpose of this paper is to reclassify the species of the subgenus *Epinomia* and to give a brief survey of their variation. The subgenus is a small one, consisting of only four species, one of which (*N. nevadensis*) is divided here into five subspecies. From an

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evolutionary and systematic standpoint, however, the group is interesting since two of its species exhibit strikingly different forms. A more detailed study of the geographical variation within one species, *N. nevadensis*, will be published elsewhere.

Descriptions of new forms are based upon the type specimens, variation encountered within the type series being indicated in parentheses. The redescriptions of previously described forms are based upon series rather than single specimens. The author has followed the terminology utilized by Michener, 1944, for all descriptive purposes. The various processes of the apical margin of the clypeus referred to in the descriptions are obscure when viewed in facial aspect and are best seen from beneath.

Measurements of width and length of face were made as follows:

1. Greatest possible width of face, including eyes.
2. Greatest possible length of face, taken along sagittal plane.

The former was chosen for statistical treatment because it is measurable with a greater degree of accuracy than the other and because it is believed to be a good index of general size.

The first segment of the labial palpus was considered to consist only of the sclerotized portion of that segment, the conjunctiva between palpus and palpiger being omitted from measurements. The length of the wing was measured from the center of the subalar area to the wing tip. No wing measurements were made of specimens with spread or curled wings. The ratio of eye width to genal width was determined with the head in perfect profile, the greatest possible measurement between anterior eye margin and posterior genal margin and between anterior eye margin and posterior eye margin being used.

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THE GENUS *NOMIA* IN THE NEW WORLD

The genus *Nomia* Latreille, 1805, (type species *Andrena curvipes* Fabricius) is a large (Dalla Torre, 1896, lists about 130 species), diverse group, widespread in distribution, with the bulk of its species in Africa, Asia and Australia. It is represented in the New World by approximately twenty species which may be divided among four subgenera: *Epinomia* Ashmead, *Acunomia* Cockerell, *Dieunomia* Cockerell, and *Paranomina* Michener.* These

* Michener, 1944, pointed out that *Paranomina* Friese is preoccupied (Conrad, 1860) and proposed *Paranomina* as a substitute, retaining *N. chalybeata* Smith as the type. *Curvinomia* Michener, 1944, named in the same paper (type *N. californiensis* Michener), is a synonym of *Paranomina* (new synonymy) and has line precedence over it. However, it is felt that *Paranomina* should take preference over *Curvinomia* because the former is based upon the original type of *Paranomina* (See Copenhagen Decisions on Zoological Nomenclature, 1953, page 67). Moreover, the status of *N. californiensis* is in doubt.

In placing certain American species in the same subgenus as *N. chalybeata*, I follow Cockerell, 1930.

subgenera comprise two diverse groups, those with bright integumental bands on the metasoma and those with bands of hair on the metasoma. The first group embraces *Paranomina* and *Acunomia*. The latter is restricted to the Americas while the former is found in Asia (and Australia?) as well. The second group contains *Epinomia* and *Dieunomia*. Again, the latter is found only in the New World while the former also has close relatives in Asia and Australia. It seems probable, therefore, that invasions of *Paranomina*- and of *Epinomia*-like bees reached this continent from Asia independently, probably before mid-Tertiary time, since they do not now occur north of about 50 degrees north latitude and hence must have reached the Western Hemisphere when the Bering Strait area was relatively warm. These two stocks are probably ancestral, respectively, to *Acunomia* and *Dieunomia*.

The four New World subgenera are distributed in a similar manner, and range from southern Washington through Minnesota and Virginia, southward to Florida, central Mexico and Baja California.¹ One subgenus (*Acunomia*) is established on the Bahamas (*N. wickhami*)², and on Cuba (*N. robinsoni*). No records of *Nomia* are known from Central or South America except *N. (Hoplonomia) expulsa* Cockerell (Cockerell, 1930) from French Guiana, and *N. (Dieunomia) heteropoda* (Say) from Brazil (see Michener in Musebeck, *et al.*, 1951, p. 1129). Both records are apparently incorrect. The distribution of these subgenera thus leaves little, if any, clue as to their origin and phylogeny. *Acunomia* is the most widespread, *Dieunomia* the least.

Acunomia and *Paranomina*, although easily separable, are morphologically similar. The relationship between *Epinomia* and *Dieunomia* is not as easily perceived. Certain *Dieunomia*, *e. g.* *N. heteropoda* (Say), differ greatly from the *Epinomia*, and certain authors have regarded *Dieunomia* as a distinct genus. Examination of the various species of *Dieunomia*, however, shows a continuous gradient of morphological divergence from the *Epinomia* group, commencing with *Nomia (Dieunomia) bolliana* Cockerell, whose female shows a striking resemblance to the female of *N. (Epinomia) triangulifera* Vachal.

Further evidence of the close relationship between *Dieunomia* and *Epinomia* has been found in the nest structure. Nests of *N. (Epinomia) triangulifera*, *N. (Epinomia) nevadensis*, and *N. (Die-*

1. Provancher's *N. compacta* (1889) from Quebec may be a small *Epinomia*, but because its description is ambiguous, and since its type locality is so far from the known range of any other *Epinomia*, it is not included in this paper, and is presumed to belong to some other genus.

2. I have not seen specimens of *N. wickhami* Ashmead, but infer from Cockerell's description (1910), that it, like *N. robinsoni*, belongs in *Acunomia*.

unomia) *heteropoda* are similar to one another and strikingly different from those of *N. (Acunomia) melanderi* Cockerell (Cross and Bohart, in press).

KEY TO THE AMERICAN SUBGENERA OF NOMIA

1. Metasomal terga without hair bands, with apical pale green, bluish, yellow, or coppery integumental bands 2
 Metasomal terga with apical hair bands (often worn off), without integumental bands 5
2. (1) Males 3
 Females 4
3. (2) Ultimate segment of antenna acuminate or at least acutely pointed, usually narrower than those preceding; basal vein of forewing only slightly arcuate; fifth metasomal sternum with median subapical processes contiguous or nearly so, arising from median longitudinal line *Acunomia*
 Ultimate segment of antenna blunt, always as wide as or wider than penultimate segment; basal vein of forewing slightly to distinctly arcuate; fifth metasomal sternum with median subapical processes distinctly separated from the median longitudinal line (except in *N. fedorensis* which resembles *Acunomia* in this respect) *Paranomia*
4. (2) Middle tibial spur finely and almost evenly serrate along entire margin; basal vein of forewing slightly to distinctly arcuate, *Paranomia*
 Middle tibial spur with but a few, uneven, coarse teeth along apical one third, basal two thirds finely and evenly serrate; basal vein of forewing only slightly arcuate *Acunomia*
5. (1) Males 6
 Females 7
6. (5) Labial palpus with segments two to four together shorter than, rarely as long as, the first segment alone. Apical antennal segment distinctly wider than penultimate segment, flattened and expanded, sometimes disclike; tegula somewhat rectangular in shape, sinuate along lateral margin; length 10-23 mm., *Dieunomia*
 Labial palpus with segments two to four together longer than first segment alone. Apical antennal segment not wider than penultimate segment, somewhat flattened but obliquely rounded distally, not expanded and disclike; tegula as described for *Dieunomia* or distinctly rounded posterolaterally; length 7-15 mm. *Epinomia*
7. (5) Labial palpus with segments two to four together rarely as long as first segment alone; pubescence of metasomal venter black, brown, deep orange, or reddish; tegula as in males; length 10-23 mm. *Dieunomia*
 Labial palpus with segments two to four together longer than first segment alone; pubescence of metasomal venter white, greyish, buffy, or light golden yellow; tegula as for males; length 8-15 mm. *Epinomia*

Using the above key, the names of the American species, as listed by Michener, in Musebeck *et al* (1951), may be placed as follows:

Epinomia

boharti sp. nov.
micheneri sp. nov.
nevadensis Cresson
triangulifera Vachal

Paranomina

californiensis Michener
fedorensis Cockerell
foxii Dalla Torre
maneei Cockerell
mesillensis Cockerell
parksii Cockerell
tetrazonata Cockerell
universitatis Cockerell
uvaldensis Cockerell
zabriskii Cockerell and Blair

Dieunomia

apacha Cresson
bolliana Cockerell
heteropoda (Say)
mesillae (Cockerell)
xerophila (Cockerell)

Acunomia

melanderi Cockerell
nortoni Cresson
robinsoni Cresson
wickhami Ashmead

Subgenus EPINOMIA Ashmead

Epinomia Ashmead, 1899, Trans. Amer. Ent. Soc., vol. 26, p. 88. Type, (*N. persimilis* Cockerell) = *Nomia triangulifera* Vachal, monobasic and original designation.

Diagnosis: This subgenus may be separated from its closest relative, *Dieunomia*, by the lengths of the segments of the labial palpi as indicated in the key. The apical antennal segment of male *Dieunomia* is distinctly wider than the penultimate segment, while in male *Epinomia* the apical segment is the same width as the penultimate. Females of *Epinomia* may be separated from those of *Dieunomia* by the color of the hairs of the abdominal venter. In *Epinomia*, these are white, greyish, buffy, or golden yellow (somewhat rufous in Mexican specimens of *N. (Epinomia) nevadensis arizonensis*, while in *Dieunomia* they are black, brown, deep orange, or rufous. *N. bolliana* Cockerell, the smallest of the species of *Dieunomia*, is perhaps the only species of that subgenus that can be confused readily with species of *Epinomia*. In addition to the above-mentioned characters, *N. bolliana* may be known from *N. triangulifera* by the shape of the horizontal rugose base of the propodeum, which is distinctly crescentic, and by the lack of striations on the anterior lateral margins of the prothorax, from *N. boharti* by the lack of impunctate transverse ridges on the first two metasomal terga, and from other species of *Epinomia* by the shape of the tegulae, which are rectangular and sinuate along their lateral margins.

Description: Male: Length 7-15 mm.; color variable, ranging from wholly black to wholly fulvous or fulvo-ferruginous except for portions of the head and mesosoma; wings yellowish-hyaline to darkly fuliginous.

Pubescence of entire body pale greyish white to light ochraceous-buff, color usually uniform on any one specimen; face, posterior margin and lobes of pronotum, posterior margin of metanotum, axilla, and propodeal spiracles all densely clothed with downy, plumose hairs; metasomal terga one to five with distinct apical bands of appressed hair, that of sixth tergum indistinct.

Segments two to four together of labial palpus longer than the first alone; apical antennal segment somewhat flattened, obliquely rounded, or almost truncate, not expanded or wider than the preceding segment; face appearing round or elliptical, eyes subparallel or slightly convergent below, inner eye margins never strongly curved, not strongly convergent above; tegula rectangular, sinuate on lateral margin, or rounded posterolaterally, thus appearing oval; basal vein of forewing only slightly arcuate; hind basitarsus usually shorter than, not distinctly longer than hind tibia; hind tibia expanded distally except in *N. boharti* where the dilation is very slight; inner apical angle of hind tibia produced, forming a distinct tooth or nodule, a median tooth along inner edge present or absent; hind femur never greatly swollen, not wider than distance between lateral ocelli; hind trochanter with or without a ventral apical nodule; middle tibia and femur unmodified; dorsal base of propodeum with a horizontal, strongly rugose area which may be either crescent-shaped or distinctly truncate posteriorly; anterior face of the first metasomal tergum with a deep, longitudinal excavation; fourth metasomal sternum with a pair of distinct, arcuate sutures, meeting posteriorly to form a median triangular area, or sutures becoming mere impressions except posteriorly, or absent entirely; fifth metasomal sternum with a pair of pubescent subapical nodules and a pair of arcuate carinae converging posteriorly to form a median triangular area; apex of sixth metasomal sternum recurved and with a deep median cleft; seventh metasomal sternum ribbon-like; eighth metasomal sternum produced to a long acuminate process posteriorly; gonostyli converging evenly, not abruptly bent mesad, modified setae on ventral portions of apices in the form of a few thick bristles; gonostyli each with a posteriorly directed ventral process.

Female: Length 8-15 mm., form more robust than male; downy plumose pubescence as in male except that of face, which is greatly

reduced; hair bands distinct on metasomal terga one to four, fifth tergum bearing densely appressed pubescence of various shades from seal brown to bright rufous, sometimes also with an indistinct hair band anteriorly; color of pubescence white to rufous, often varied on any one specimen; pubescence of metasomal venter long, white to golden yellow, becoming rufous in some Mexican specimens of *N. nevadensis arizonensis*, face wider than in male; other structural characters as given in description of male.

Habits: Information concerning the habits of *Epinomia* is scanty, and much remains to be done in this respect. Bohart (1952, also in litt.), Cockerell (1934), Cross and Bohart (in press), Linsley and MacSwain (in litt.), Pierce (1904), Rau (1929), and Snelling (in litt.) have studied *N. triangulifera* and *N. nevadensis*.

These bees nest gregariously, often in large densely populated sites, but insofar as known they are true solitary bees, each female digging and provisioning one or more nests in a season, after which she dies, leaving her progeny to repeat the cycle the ensuing year. Adults generally appear in middle or late summer, although there is some evidence of a longer season in areas having summer rains where it is possible that several generations occur in the same year.

Insofar as known, the females prefer the flowers of various composites. G. Bohart (in litt.) mentions the possible importance of this group in areas where sunflower seed is grown for oil.

KEY TO THE AMERICAN SPECIES OF THE SUBGENUS EPINOMIA

- | | | |
|--------|---|----------------------|
| 1. | Anterior lateral portion of prothorax with a series of vertical or nearly vertical striations; basal area of propodeum distinctly truncate posteriorly; tegula somewhat rectangular in shape, lateral margin distinctly sinuate; dark species, 11-15.5 mm. long | |
| | | <i>triangulifera</i> |
| | Anterior lateral margin of prothorax without striations; basal area of propodeum crescent-shaped or weakly truncate posteriorly; tegula as in <i>N. triangulifera</i> or rounded posterolaterally, appearing somewhat oval; species dark or with varying amounts of fulvous or ferruginous, 7-12.5 mm. long | 2 |
| 2. (1) | Males | 3 |
| | Females | 5 |
| 3. (2) | Hind tibia with distinct median excavation and usually with a tooth basal to it along anterior inner edge (fig. 4, G, H), | |
| | | <i>nevadensis</i> |
| | Hind tibia without median tooth or excavation along anterior inner edge | 4 |
| 4. (3) | Hind tibia greatly expanded distally, apex (including tooth) half as wide as length of segment; tegula rounded posterolaterally, appearing somewhat oval in shape; clypeal margin with a | |

- single, rectangulate median process*, the apex of which is not sinuate (fig. 3, F, G)..... *micheneri*
 Hind tibia not greatly expanded distally, apex (including tooth) not half as wide as length of segment; tegula as described for *triangulifera*; clypeal margin with a single median process, the apex of which is distinctly sinuate (fig. 3, I)..... *boharti*
5. (2) First two metasomal terga each with a distinct, transverse, sub-apical, rounded carina that is impunctate and shining; tegula as described for *N. triangulifera*..... *boharti*
 First two metasomal terga without carinae as described above; tegula rounded posterolaterally, appearing rather oval..... 6
6. (5) Apical margin of clypeus with a pair of distinct median teeth † (fig. 3, K)..... *micheneri*
 Apical margin of clypeus not dentate..... *nevadensis*

Nomia (Epinomia) triangulifera Vachal

(Fig. 1; 3A, E, I; 4 A, E)

Nomia triangulifera Vachal, 1897, *Miscellanea Entomologica*, vol. 5, p. 9. (male).

Nomia persimilis Cockerell, 1898, *Denison Univ. Sci. Labs. Bull.*, vol. 11, pp. 50, 72; and *Bull. Univ. New Mexico*, vol. 1, pp. 50, 72.

Diagnosis: Although the females of this species superficially resemble *N. (Dieunomia) bolliana*, either sex may be readily separated from the latter, as well as from any species of *Epinomia*, by the presence of a series of vertical or nearly vertical striations on the lateral anterior portions of the prothorax. *N. triangulifera* is also separable from all other forms of *Epinomia* except *N. nevadensis bakeri* by the shape of the horizontal rugose base of the propodeum, which is truncate rather than crescent-shaped, and from all forms of *Epinomia* except *N. boharti* by the shape of the tegulae, which are rectangulate.

Description of male:

Size: Length 12-15.5 mm.; length of forewing 9.0-12.5 mm.; width of face 2.9-3.2 mm.; length of face 3.0-3.7 mm.

Color: Usually wholly black, two basal metasomal segments occasionally somewhat piceous; legs black to piceous; antenna black or becoming reddish beneath; tegula translucent-testaceous to dark brown; wings with a dull orange or brownish tint or subhyaline, apical one fifth infuscate, sometimes lightly so; veins and stigma yellow-brown to dark brown.

Pubescence: Pale throughout, that of head, sides and venter of mesosoma and femora and tibiae of legs white or grayish white; that of mesonotum greyish or pale buffy white, densest on anterior

* Seen best from beneath.

† Seen from beneath.

one third; fasciae of metasomal terga one to five white; metasomal sterna two and three with several thin rows of long, shortly-plumose hairs and with short, subapical fringes of feathery plumose setae which are recurved medially, particularly on sternum three, and which are prolonged laterally to form tufts; sternum four with a thin apical fringe, also becoming tufted laterally; middle femur beneath with a few, scattered, short bristles; front femur beneath evenly and sparsely covered with tiny setae.

Punctuation: That of clypeus very fine, subcancellate, becoming coarser above, that of vertex coarser and sparser, areas about ocelli often minutely reticulate; punctures of mesoscutum close, coarse, similar to those of vertex, those of mesoscutellum coarser, variable in size and distribution, sparsest medially; first four metasomal terga with very fine and close punctures, the first, and sometimes the second with two distinct sizes, the coarser usually sparsely and evenly distributed among the finer; punctures of tergum five about as fine as the finer punctures of the first four but more sparse. All punctured surfaces moderately shining.

Structure: Apical margin of clypeus with a wide, slightly produced truncation (fig. 3, E); first flagellar segment almost as long as second, segments two to ten approximately equal in length, about .48 mm. each, apical (11th) segment longer, about .65 mm; face almost round, ratio of length to width 1:1.00-1:1.08; genal area about one and one quarter times as wide as eye; labial palpus with segments two to four together distinctly longer than first free segment alone; anterior lateral portion of prothorax with a series of vertical or nearly vertical striations; tegula with posterolateral angle rather abrupt, appearing somewhat rectangular, shallowly sinuate along lateral margin; horizontal rugose basal area of propodeum truncate posteriorly, somewhat polished; posterolateral angles of propodeum distinctly angulate, becoming sharply carinate ventrally; first three metasomal terga with shallow transverse basal constrictions; hind trochanter quadrate, without ventral nodule; hind femur as described for *N. nevadensis*; hind tibia expanded evenly distally, not excavated medially, roughly triangular in shape, anterior inner margin produced to form a large apical tooth (fig. 4, E); fourth metasomal sternum with a pair of distinct, arcuate sutures which converge posteriorly to form a median triangular area; tubercles of fifth sternum large, angulate, sinuate along posterior margin, reticulate, lacking conspicuous pubescence (fig. 4, A); apex of gonostylus as seen in ventral aspect acuminate-rounded (fig. 3,

A); length of ventral process of gonostylus about .54 mm.; ratio of length of ventral process of gonostylus to length of gonostylus about 1:2; subapical ventral margin of gonostylus with four to five distinct long rather stout bristles; laterodistal process of penis valve falcate.

Description of Female:

Size: Length 11.5-14 mm.; length of forewing 9.5-11.5 mm.; width of face 3.2-3.8 mm.; length of face 2.7-3.3 mm.

Color: As described for male except that antennae are sometimes wholly reddish.

Pubescence: That of face, sides and venter of mesosoma white, that of mesoscutum greyish-white to pale buffy-white; fasciae of metasomal terga one to four white, often worn on discs; fifth metasomal tergum with an apical fringe of thickly appressed, seal brown hairs, another row of appressed hairs just basad, these often lighter; apical one third of metasomal sterna two to six with very long hairs, thickest on sterna four and five, greyish white to buffy white tinged with gold; scopa long, white to buffy brown, hairs along posterior margin of hind tibia buffy white to brown admixed with buff; hairs on outer side of middle tibia whitish to buffy brown, admixed with bristles of seal brown.

Punctuation: Face punctured as in male; punctures of mesoscutum coarse and close, slightly larger than those of vertex, those of mesoscutellum variable in size but finer and much closer than those of mesoscutum; metasomal terga punctate throughout, the first two with fine and very close punctures, those of the third finer and somewhat sparser, those of the fourth still finer and distinctly more sparse than those of the third; under surfaces of front and middle femora as described for male; all punctured surfaces moderately shining.

Structure: Apical margin of clypeus with truncations as described for male, or truncation reduced or absent (fig. 3. J); face wider than that of male, ratio of length to width 1:10-1:19; genal area about one and one-fourth times as wide as eye; transverse basal constrictions of first three metasomal terga shallow, often nearly lacking, raised areas behind constrictions also lacking.

Variation: Despite its wide range, this species exhibits comparatively little interpopulational variation in the characters studied. Color variation is very slight, specimens from desert localities in New Mexico and Utah having at most the two basal terga fuscous rather than black. Size differences are apparent within populations

but are more difficult to establish between them. In one instance, the means of measurements of the facial width, calculated for males from two widely separated localities (Topaz, Utah and Lawrence, Kansas) and using sample sizes of 18 and 25 specimens, respectively, differed by only .125 mm. (3.479 mm.-3.354 mm.). A difference of means test applied to this difference, however, resulted in a significant "t" of 2.88, ($P < .01$) indicating that the means of the two populations were significantly different for the character tested.

No differences in wing color and punctation between populations were found, although intrapopulational variation was observed. A slight difference in the pubescence of the legs was found to exist between females from the Utah populations and those of the plains populations, a high percentage of the former exhibiting more brown hairs on the outer sides of the middle tibiae and along the posterior margins of the hind tibiae.

Distribution: Central and west central United States, from southern Kansas and New Mexico, north to central Minnesota and southern North Dakota, and from central Illinois west to western Utah (fig. 1).

Type material: The location of the type of *triangulifera* is not known to me. A lectotype female of *persimilis* from Las Cruces, New Mexico (Ckll. # 4885) is here designated and returned to the University of Nebraska collection.

Specimens examined: COLORADO: Alamosa, Elbert. ILLINOIS: Meredosia. IOWA: Sergeant's Bluff, Sioux City. KANSAS: De Soto, Douglas Co., Eudora, Hutchinson, Larned, Lawrence, Nickerson, Phillips Co., Syracuse. MINNESOTA: St. Paul. MISSOURI: Amazonia, Clay Co., St. Louis. NEBRASKA: Cedar Bluffs, Lincoln, Mitchell, Nebraska City, Omaha, West Point, Wymore. NEW MEXICO: Albuquerque, Las Cruces, Montoya. NORTH DAKOTA: Mcleod, Mott. SOUTH DAKOTA: Elk Point. UTAH: Lampo, Penrose, Promontory, Topaz.

Total number of specimens examined: 254 males, 148 females. The majority of these were caught between Aug. 10, and Sept. 15. Males have been found as early as July 7, and females as late as Oct. 2. No difference as to flight season between eastern and western populations is discernible.

Flower Records: *Bidens involucrata*, 1 ♂, 4 ♀; *Cleome serrulata*, 2 ♂; *Gilia* spp., 2 ♂; *Grindelia squarrosa*, 1 ♂, 1 ♀; *Grindelia*, spp., 2 ♂, 2 ♀; *Helianthus annuus*, 16 ♂, 36 ♀; *H. lenticularis*, 5 ♂, 7 ♀; *H. maximiliani*, 4 ♂; *H. petiolaris*, 1 ♂; *Helianthus* spp., 14 ♂, 4 ♀;

Medicago sativa, 1 ♀; *Polygonum* spp., 3 ♂; *Rudbeckia triloba*, 1 ♂, 1 ♀; *Silphium perfoliatum*, 4 ♂, 2 ♀; *Solidago* spp., 2 ♂; *Vernonia* spp., 3 ♂.

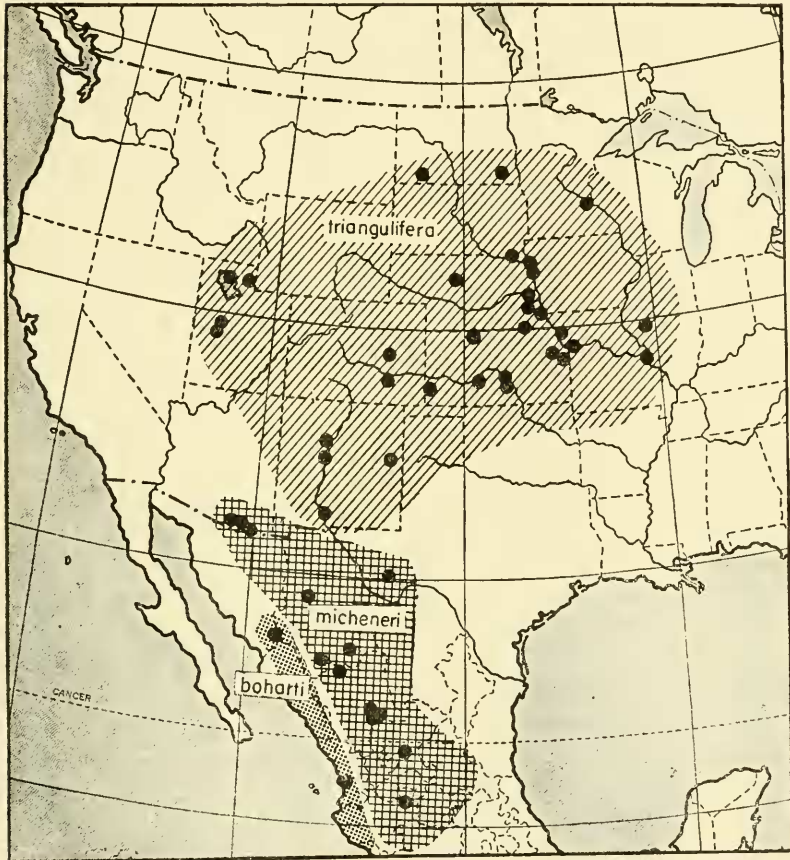


FIG. 1. Map showing the distribution of *N. (Epinomia) boharti*, *N. (E.) micheneri*, and *N. (E.) triangulifera*.

Nomia (Epinomia) micheneri,* sp. nov.

(Figs. 1; 3B, F, G, K; 4B, F)

Diagnosis: This rather large, variably colored species is sympatric with *N. nevadensis arizonensis* throughout much of its range and superficially resembles that form. The males are immediately separable from those of the other *Epinomia* by the margin of the clypeus, which bears a single rectangulate median process, the apex of which

* This species is named for Dr. Charles D. Michener, University of Kansas.

is not sinuate. The hind tibia of the male is also distinctive, being broadly dilated apically and lacking a median excavation on the anterior inner edge, somewhat resembling that of *N. triangulifera*. Unlike *triangulifera*, however, the large inner tooth is subapical rather than apical (fig. 4, F).

Both sexes may be distinguished from *triangulifera* by the absence of striations on the anterior lateral portions of the prothorax and by the shape of the horizontal rugose basal area of the propodeum, which is crescentic. They may also be distinguished from *triangulifera*, as well as from *boharti*, by the shape of the tegulae, which are rather arcuate posterolaterally.

In the northern parts of its range, *micheneri* is distinctly larger than *nevadensis arizonensis*, but in central Mexico the two species are commonly equal in size (see section on variation). Like *nevadensis*, the color of *micheneri* may range from wholly black to partly fulvo-ferruginous. In partially red males, however, the first metasomal tergum alone is usually fulvo-ferruginous, while such males of *nevadensis* usually have the first two metasomal terga colored. The females are rather difficult to distinguish from those of *nevadensis*, the most distinct character being a pair of small teeth situated medially on the apical margin of the clypeus. Also, partially red females of *micheneri* usually have only the first two metasomal terga fulvo-ferruginous, while those of *nevadensis* generally have the first three terga of that color. The mesoscutellum of *micheneri* often bears a pair of mediolateral impunctate areas which are usually lacking in *nevadensis*.

Description of male:

Size: Length: 12.1 mm. (9.0-12.1); length of forewing 11.4 mm. (9.2-11.8); width of face 2.89 mm. (2.38-2.92).

Color: Head black; mesosoma black (or posterior portion of mesonotum fulvo-ferruginous); metasomal terga two to five black, metasomal tergum one and the apex of tergum two fulvo-ferruginous (metasomal terga wholly black to first two and part of third fulvo-ferruginous); coxae fuscous (to black); trochanters fuscous (to black); fore and middle femora piceous basally, becoming fusco-fulvous distally (or entirely black); posterior femora fulvo-ferruginous (to black); antennae darkly fuscous (wholly black to fuscous with reddish beneath); tegulae translucent testaceous (to dark testaceous); wings yellowish hyaline (to brownish hyaline), apical one fifth infuscate, nervures and stigma yellow-brown to dark brown.

Pubescence: Pale throughout, similar to that described for the

male of *N. boharti*. Head, sides and venter of thorax, and femora and tibiae with long greyish-white hairs, those of mesoscutum thin, buffy white (or greyish white); fasciae of metasomal terga one to five white (to buffy white); metasomal terga one to five with several thin rows of long, rather stout, posteriorly directed hairs just basad of fasciae (not as prominent on tergum one in some), rest of these terga sparsely and evenly covered with shorter whitish hairs (or these as long as prefascial hairs); subapical fringes of short hair on metasomal sterna two and three as described for *N. boharti* (more distinct in some *micheneri*), apical fringe of sternum four absent (rather dense, long subapical fringe sometimes present); middle femora beneath bare and shining medially, front femora also bare beneath medially, patches of tiny setae present posterobasally, apically, and along anterior margin.

Punctuation: That of clypeus and paraocular areas close and coarse, that of vertex coarser and sparser except behind ocelli, deeper than that of *boharti*; punctures of mesoscutum only a little coarser than those of vertex, about as close, those of mesoscutellum variable in size (to almost uniform in size), densest around periphery and along median scutellar line, sparser mediolaterally (or having impunctate areas mediolaterally), with a medium polish; posterior surfaces of propodeum as described for *boharti*; punctuation of first tergum coarse and rather sparse basally, becoming finer and closer apically (to evenly and more finely punctate throughout), second tergum with punctuation as in apical portion of first, that of third finer and closer than that of second, that of fourth finer and as close as that of third, that of fifth still finer and closer than that of fourth; middle femora impunctate and polished beneath, except for a few variable punctures basally; front femora impunctate beneath medially, but having tiny, shallow punctures basally and anteroapically; all punctured surfaces with a medium polish.

Structure: Apical margin of clypeus with a single, narrow, rectangular process which differs from that described for *boharti* in that its apex is truncate rather than emarginate (fig. 3 F, G); antennae with first flagellar segment about five-sixths as long as second, segments two to ten equal in length, about .45 mm. (about .41 mm. in some specimens), apical longer, about .54 mm.; face wider than long, appearing rather elliptical, ratio of length to width about 1:1.14; labial palpi as described for *boharti*; eyes about as wide as genal areas behind them. Anterior lateral portion of prothorax smooth and shining except for a few scattered punctures;

tegula with posterolateral angle rather rounded, never abrupt; horizontal rugose basal area of propodeum crescent-shaped; posterodorsal angles of propodeum rounded, broadly so dorsally. Transverse basal constrictions of first three metasomal terga as described for *boharti* but excavations more shallow. Hind trochanter quadrate, without ventral nodule; hind femur feebly carinate basally along both anteroventral and posteroventral angles, carina distinctly more pronounced along latter (in most, anteroventral carina subequal to posteroventral one); hind tibia expanded broadly apically, without median excavation, width at apex, including inner tooth, much more than half of length; inner tooth large, appearing subapical (fig. 4, F); fourth metasomal sternum without converging sutures (or a pair of sutures or impressed lines present, these converging posteriorly to form a median triangular area as described for *N. triangulifera*); tubercles of fifth sternum small, nodulate, not pubescent (fig. 4, B); apex of gonostylus as seen in ventral aspect acuminate (fig. 3, B); ventral process of gonostylus about .35 mm. long; ratio of length of ventral process to length of gonostylus 1:2.2; subapical ventral margin of gonostylus with two to five small indistinct bristles; laterodistal process of penis valve tuberculate.

Description of female:

Size: Length, 11.9 mm. (11.0-12.2); length of forewing 10.8 mm. (9.9-10.8); width of face 3.43 mm. (2.61-3.43); length of face 2.82 mm. (2.82-2.88).

Color: Head and mesosoma black (ferruginous spots on posterior face of propodeum in one specimen); antennal scape fusco-fulvous (to fuscous), flagellum black; metasomal terga three to five black, except for a narrow fusco-fulvous line basad of the fasciae on terga three and four (or fusco-fulvous line restricted to tergum three or absent altogether); metasomal terga one and two fulvo-ferruginous; coxae and trochanters darkly fulvous to fuscous (or black), remaining leg segments fulvous except for basal one fourth of femora, which are fusco-fulvous (or remaining segments entirely fulvous); wing color as described for male but slightly darker.

Pubescence: Pale throughout, that of face, sides, and venter of mesosoma buffy white, that of mesoscutum sparse, pale ochraceous-buff; fasciae of metasomal terga one to four buffy white (to light ochraceous-buff); several thin rows of long stiff posteriorly directed hairs present just basad of fasciae on terga one to four (these absent or indistinct in some Mexican specimens) pale yellow to golden in color; apical fringe of tergum five rufescent; apical one third of

metasomal sterna two to five with long, light ochraceous-buff hairs; discs of terga one to five without feathery-plumose appressed hairs, but with sparse erect or suberect hairs; scopal hairs long, buffy white, hairs along posterior margin of hind tibia buffy white (or tinged with rufous); hairs on outer side of middle tibia buffy white tinged with rufous.

Punctuation: That of clypeus very coarse and close, that of vertex a little finer and sparser except behind ocelli; punctures of mesoscutum like those of vertex but very close, those of mesoscutellum like those of mesoscutum, densest around periphery and along median mesoscutellar line, leaving a pair of shining, impunctate lateromedian areas (not well defined in all specimens); metasomal terga punctate throughout, first two with medium-fine and rather close punctures, punctures of third finer and as close as those of second, those of fourth tergum still finer and somewhat closer than those of third; middle femur beneath with coarse sparse punctures basally and posteriorly, impunctate medially (or with a few scattered punctures); front femur beneath generously and evenly spotted with minute punctures, heaviest on basal two thirds.

Structure: Face about as wide as that of male but shorter (ratio of length to width 1:1.22 [1:1.18-1:1.25]); apical margin of clypeus with a pair of small median teeth similar to those described for *boharti* but less prominent; genal area about one and one-fourth times as wide as eye; first three metasomal terga only shallowly constricted basally, area immediately posterior to constriction not prominently raised.

Variation: *N. micheneri* is a polychromatic species comparable in color variation to certain forms of *N. nevadensis*. This variation has been stated as fully as possible in the description of the species, and no further discussion will be made here. Its geographical occurrence in males is shown in a general way in Table I. Because of the paucity of specimens and lack of reliable climatological data, no attempt will be made here to correlate climatic factors with color differences as was done with *N. nevadensis*, but it seems likely that a correlation exists as in that species.

Another important variable in *micheneri* is size. Table I will suffice to show that in males this character varies rather consistently in a general north-south direction with the largest specimens being from the northernmost portions of the range, a notable exception being the specimens from Jalostotitlán, Jalisco. Because of their distinct differences in size, it is felt that the specimens examined possibly represent more than one subspecies and it is for this reason

that only the northernmost specimens have been designated as types.

The specimens from Jalisco are indicative of the extreme variability which may be found in the species. Although reference to Table I indicates that only one male specimen from San Juan de Los Lagos was measured, two others were examined. Both were noticeably smaller than specimens from any other part of the species range, and in addition were partly red. Six miles northeast of Jalostotitlán, at a distance of only six miles from the above locality, a sample of ten very large, wholly black males was taken. Only males from southern Arizona and northern Chihuahua were larger than these.

The sutures of the fourth sternum of the male are highly variable. In both *micheneri* and *boharti*, these sutures may be absent, feeble and incomplete, or distinct and complete. They are invariably present in *nevadensis* and *triangulifera*.

Distribution: The species is apparently restricted to the Mexican Plateau and southern Arizona. Most of the specimens before me are from the mesquite-grassland or live-oak regions in higher altitudes, ranging up to 7500 feet.

TABLE I—Facial measurements (in mm.) and color variation in males¹ of *Nomia (Epinomia) micheneri*

Localities	No. specimens	Color ² (in percent)		Mean, width of face ± S. E.	Mean, length of face ± S. E.
		Partly red	Wholly black		
So. Arizona ³	5	100	000	3.340 ±.032	2.860 ±.035
Matachic, Chihuahua	2	000	100	3.351	2.812
So. Chi- huahua ⁴	14	85	15	3.079 ±.028	2.585 ±.025
So. Durango ⁵	4	50	50	3.067 ±.067	2.515 ±.054
San Juan de los Lagos, Jalisco	1	100	000	2.862	2.416
Jalosto- titlán, Jalisco	10	000	100	3.174 ±.026	2.591 ±.028
León, Guanajuato	1	000	100	3.162	2.550

1. Females are not included because adequate samples of them were not available over most of the species range.

2. Because of the small number of specimens examined, a detailed listing of all color differences is impractical here. Specimens listed in the column headed "partly red" had at least the basal metasomal tergum fulvo-ferruginous.

3. Includes males from Sonoita (2); 10 miles east of Sonoita (1); 10 miles west of Bisbee (1); mouth of Carr Canyon, Huachuca Mts. (1).

4. Includes males from Santa Bárbara, Chihuahua (7); Ojito, Chihuahua (1); Jiménez, Chihuahua (4); Canutillo, Durango (2).

5. Includes males from San Lucas (2); San Juan del Río (1); Yerhanis (1).

Type material: Holotype male from Sonoita, Arizona, Aug. 9, 1940 (P. H. Timberlake); allotype female from 25 miles east of Sonoita, Aug. 9, 1924 (E. P. Van Duzee). Eight male and female paratypes as follows: one male from Sonoita, Aug. 9, 1940 (P. H. Timberlake), two males from ten miles east of Sonoita, Aug. 9, 1940 (E. S. Ross), one male from ten miles west of Bisbee, Arizona, Aug. 10, 1940 (E. S. Ross), one male from Carr Canyon, Huachuca Mts., Arizona, Aug. 10, 1940 (C. D. Michener), one male from near Ramsay Canyon, Huachuca Mts., Arizona (P. H. Timberlake), one female from Douglas, Arizona, Aug. 27, 1939 (R. H. Crandall), and one female from Alpine, Texas, July 7, 1942 (E. C. Van Dyke).

Type repositories: Holotype, allotype, one female and two male paratypes to the California Academy of Science, two male paratypes to the collection of Prof. P. H. Timberlake, one male paratype to the collection of Dr. G. E. Bohart, one male paratype to the Snow Entomological Museum at the University of Kansas, and one female paratype to the University of Arizona at Tucson.

Specimens examined: CHIHUAHUA: Matachic, July 7, 1947 (Rockefeller Exped.—Michener), 2 ♂; Santa Bárbara, July 17-18, 1949 (Rockefeller Exped.—Michener), 3 ♂, 1 ♀; July 17, 1947 (Rockefeller Exped.—Cazier), 3 ♂; Aug. 17, 1947 (G. M. Bradt), 1 ♂; Ojito, 36 kilo, St. Bárbara, Sept. 29, 1947 (G. M. Bradt), 1 ♂; 10 miles W. Jiménez, Sept. 11, 1950 (R. F. Smith), 4 ♂. DURANGO: 8 miles S. Canutillo, Aug. 9, 1951 (P. D. Hurd), 2 ♂; San Juan del Rio, Aug. 7, 1951 (H. E. Evans), 1 ♂; San Lucas, Aug. 2, 1947 (Rockefeller Exped.—Michener), 2 ♂; Yerbanis, Aug. 19, 1947 (Rockefeller Exped.—Michener), 1 ♂. ZACATECAS: Fresnillo, Aug. 15, 1947 (Rockefeller Exped.—Michener), 1 ♂. JALISCO: San Juan de los Lagos, July 27, 1951 (P. D. Hurd), 3 ♂; Jalostotitlán, July 19, 1954 (Univ. Kans. Mex. Exped.) 10 ♂. GUANAJUATO: 6 miles N.W. León, Aug. 9, 1954 (Univ. Kans. Mex. Exped.), 1 ♂.

Flower records: No flower records are available for the females, but three males have flower labels attached as follows: Yerbanis, Durango, on *Helianthus*; Canutillo, Durango, on *Guardiola tulo-carpa*; and San Juan de los Lagos, Jalisco, on *Eysenhardtia polystachya*.

Nomia (*Epinomia*) *boharti*,* sp. nov.

(Figs. 1; 3D, I, N; 4D, I)

Diagnosis: This rather small black species most nearly resembles certain black subspecies of *N. nevadensis*. It is immediately sepa-

* This species is named in honor of Dr. George E. Bohart, U. S. Legume Seed Research Lab., Logan, Utah, without whose guidance and encouragement this paper would not have been written, and from whose private collection the type series was taken.

rable from the latter group, however, by the shape of the tegula, which has the posterolateral corner abruptly bent in the same manner as *N. triangulifera*. The males may be distinguished from those of any other *Epinomia* by the distinctive shape of the hind tibia and the shorter antenna. The females are likewise separable from others of the subgenus by the presence of highly polished, impunctate ridges immediately basad of the fasciae on metasomal terga one to three (more distinct on terga one and two).

Description of Male:

Size: Length 10 mm. (9.7-10.4); length of forewing 9.5 mm.; width of face 2.9 mm. (2.82-3.02); length of face 2.55 mm. (2.51-2.58).

Color: Head, mesosoma, and metasoma black; legs black to piceous; antenna black, becoming fuscous beneath (or entirely black); tegula very pale testaceous, subhyaline; wings brownish hyaline (hyaline to yellow-brown hyaline), veins and stigma yellow brown to dark brown.

Pubescence: Generally pale and rather sparse, hairs often shortly plumose; hairs of head, sides and venter of mesosoma, and femora and tibiae white to greyish white (or buffy white), pubescence of mesoscutum sparse, greyish white (to buffy white); fasciae of metasomal terga one to five buffy white to ochraceous-buff; terga three to five with several thin rows of long, rather pale, yellowish hairs just basad of fasciae, tergal discs otherwise evenly covered with whitish (to pale ochraceous-buff) suberect hairs, these becoming much longer laterally; subapical fringes of short hair on the second and third metasomal sternum barely evident, not recurved; apical fringe of fourth sternum absent, subapical fringe present; middle femur beneath clear and shining but for a patch of small setae posterobasally; front femur bare and shining except for a patch of fine basal setae and a few coarse, scattered hairs anteriorly.

Punctuation: That of clypeus and paraocular areas close and coarse, that of vertex much sparser and coarser; mesoscutum shining, punctures as sparse as those of vertex but coarser and deeper, those of mesoscutellum similar to those of posterior one third of mesoscutum, densest around periphery and along median scutellar line, sparser in mediolateral areas; dorsolateral angles of propodeum almost impunctate, brightly shining, posterior face of propodeum also shining, very coarsely and sparsely punctate; punctuation of first and second metasomal terga moderately fine, even and close, third more finely punctate than the first two, fourth with punctures finer but no closer than those of third; middle femur beneath impunctate ex-

cept for a few fine punctures basally and posteriorly, front femur beneath with only a few tiny basal punctures and larger scattered punctures along anterior margin; integument in general highly polished.

Structure: Apical margin of clypeus with a rather narrow, emarginate protuberance (fig. 3, I); antenna noticeably shorter than in other male *Epinomia*, first flagellar segment about three-fourths as long as second, segments two to ten equal in length, about .34 mm. each, apical (11th) segment longer, about .39 mm.; face wider than long, appearing elliptical, ratio of length to width 1:1.15 (1:1.13-1:1.17); labial palpus with segments two to four together shorter than those described for *N. triangulifera*, but still distinctly longer than the first segment alone; eye a little wider than genal area behind it; anterior lateral portion of prothorax smooth, shining, nearly impunctate; tegula with posterolateral angle rather abrupt as described for *N. triangulifera*, lateral margin shallowly sinuate; horizontal rugose basal area of propodeum crescent shaped; dorsolateral angles of propodeum rounded, broadly so dorsally; transverse basal excavations of terga one to three deep (that of tergum three shallower than basal two), the areas immediately posterior raised, first three terga thus appearing corrugated when viewed in profile; hind trochanter quadrate, without ventral nodule; hind femur with posteroventral angle sharp (to carinate), anteroventral angle rounded; hind tibia expanded only slightly apically, width at apex, including inner tooth, much less than half the length (fig. 4, I); inner tooth small, barely subapical; anterior inner margin of hind tibia without a median excavation; fourth metasomal sternum without converging sutures (or a pair of sutures or impressed lines present, these converging posteriorly to form a median triangular area as described for *N. triangulifera*); tubercles of fifth sternum wide, rounded on posterior margin, with conspicuous bladeliike setae (fig. 4, D); apex of gonostylus as seen in ventral aspect, emarginate, with a dorsal, medially directed, pubescent, triangular flange, (fig. 3, D); length of ventral process of gonostylus about .4 mm.; ratio of length of ventral process of gonostylus to length of gonostylus about one to two; subapical ventral margin of gonostylus with about eight short, spinose setae; laterodistal process of penis valve tuberculate.

Description of female:

Size: Length 9.5 mm.; length of forewing 9.4 mm.; width of face 2.9 mm.; length of face 2.4 mm.

Color: That of head and mesosoma as in male, metasoma fuscous (to black); legs fuscous, antennae tinged with reddish (to black); tegulae as in male; wings yellow-brown (to brownish-hyaline), apical one fifth lightly infuscate (to darkly infuscate); veins and stigma yellow-brown to dark brown.

Pubescence: That of face, sides and venter of mesosoma buffy white (to grayish white); dense, downy plumose pubescence of dorsolateral angles and lobes of pronotum, mesonotum and axillae light ochraceous-buff (darker on Nayarit female); hairs of mesoscutum sparse, light ochraceous-buff (to ochraceous-buff); fasciae of metasomal terga one to four light ochraceous-buff, apical fringe of fifth tergum buffy, with a tinge of rufous; stiff, posteriorly directed prefascial hairs absent; discs of terga one to five without feathery-plumose appressed hairs; apical halves of metasomal sterna two to five densely covered with long, light buff hairs; scopa buffy, hairs along posterior margin of hind tibia ochraceous to pale rufous; hairs on outer side of middle tibia buffy, becoming ochraceous to pale rufous apically.

Punctuation: That of clypeus coarse and close, that of vertex a little coarser and much sparser; punctures of mesocutum about as coarse as those of vertex but closer, those of mesoscutellum like those of mesoscutum, densest around periphery and along median mesoscutellar line, leaving a pair of shining, impunctate latero-median areas; metasomal terga one to three each with a distinctly shining, impunctate, transverse ridge just basad of fascia, more prominent on terga one and two, terga otherwise punctate throughout; punctures of first metasomal tergum as described for male, that of second closer and finer than that of first, that of third much finer (one half the size of those on terga one and two) and slightly closer than that of second; middle femur beneath with a few coarse punctures basally and posteriorly, front femur beneath generously spotted with minute shallow punctures.

Structure: Face no wider than that of male, facial length-to-width ratio also as described for male; apical margin of clypeus with a pair of median teeth separated by about twice the width of one of their bases, margin between them sinuate (fig. 3, N); width of genal area subequal to that of eye; first three metasomal terga strongly excavated basally, the first two more so than the third, areas immediately posterior to excavations distinctly raised, impunctate, and with a high polish.

Variation: Both sexes from Nayarit exhibit darker pubescence

and antennae than those from San Bernardo. Because of the small sample sizes at hand, it was therefore deemed best to exclude the former population from the type series. Intrapopulational variation includes size, shape and size of the protuberances of the clypeal margin, and, in the male, the presence or absence of the posteriorly converging sutures of the fourth sternum. These last two characters are also variable in *N. micheneri* but remain constant in *N. triangulifera* and *N. nevadensis*.

Distribution: Apparently restricted to the forested areas of western Mexico.

Type material: Holotype male, allotype female, and three paratypes, San Bernardo, Sonora, Mexico, Aug. 16, 1935 (collector unknown).

Type repositories: Holotype and allotype to the California Academy of Sciences, one paratype to the University of California at Davis, one paratype to the private collection of Dr. G. E. Bohart, and one paratype to the Snow Entomological Museum at the University of Kansas.

Specimens examined: NAYARIT: 5 mi. E. San Blas, Elev. 25 ft., July 25, 1953 (Kans. Univ. Exped.), 5 ♂, 1 ♀.

Habits: Nothing is known of the habits of this species. The Nayarit series was taken on an unidentified yellow composite which grew in open areas in a tropical forest. Several of the males from the same series had mud caked on the hind tibiae and presumably had recently been underground.

Nomia nevadensis Cresson

This widespread polychromatic species occurs throughout the southern half of the United States and is found as far south as the state of Jalisco, Mexico. Five easily separable forms are found within this range, and these have been retained (or designated) as subspecies to show their close relationship. In a paper yet to be published, the author has attempted to associate various climatic factors with the integumental color of this species. There is evidence that such color is well correlated with relative humidity.

The following characters will facilitate separation of this species from the remaining *Epinomia*.

Diagnosis: Both sexes may be separated from specimens of *N. triangulifera* by the absence of striations on the anterior lateral portion of the prothorax. The males are separable from those of the other *Epinomia* by the shape of the hind tibia, which is broadly dilated apically, and which possesses a curved median excavation

(fig. 4, G, H). Females are distinguished from those of *boharti* by the shape of the tegula, which is rather arcuate posterolaterally, and by the absence of impunctate, shining ridges on the first three metasomal terga. They are more difficult to distinguish from those of *micheneri*, the most distinct characters being size (in the U. S. specimens) and the absence of distinct teeth on the apical margin of the clypeus. Both characters are somewhat variable; the distinctive characters are further discussed under *N. micheneri* and reference to the descriptions and to the diagnosis of the latter species is advised.



FIG. 2. Map showing the distribution of *N. (E.) nevadensis*.

Nomia nevadensis nevadensis Cresson

(Figs. 2; 3C, H; 4C, H)

Nomia nevadensis Cresson, 1874, Trans. Amer. Ent. Soc., vol. 5, p. 101; also Cresson, 1875, in Wheeler, Report upon Geographical and Geological Explorations and Surveys West of the 100th Meridian . . . Vol. 5 (Zoology), p. 722, Pl. XXXIV.

Description of male: *

Size: Length 10.7 mm. (measured from a specimen from Fairbank Springs, Nev.); length of forewing 9.8 mm.; width of face 2.92 mm. (2.92-3.12); length of face 2.65 mm. (2.65-2.95).

Color: Face black but for apical margin of clypeus, which is fulvous (face entirely black to face black, clypeus admixture of fuscous and fulvous areas); mesosoma fuscous anteriorly, posterior one third becoming fulvous (to mesosoma entirely fulvous but for black mesoscutum); metasomal terga one to three fulvous, four and five fuscous (to metasomal terga one to two fulvous, three to five black); coxae and trochanters fuscous to fulvous, remaining segments of legs fulvous; antennae piceous above, becoming lighter beneath; tegulae translucent-testaceous (to hyaline), wings pale yellowish hyaline, nervures and stigma yellow brown to dark brown.

Pubescence: (The following is based upon specimens taken at Fairbanks Springs, Nevada, since the original types have been immersed in alcohol and the hair color has doubtless been altered.)

Pubescence pale throughout. Head, sides and venter of mesosoma, and femora and tibiae with greyish white hairs, that of mesoscutum moderately dense, thickest anteriorly, greyish white; fasciae of metasomal terga one to five buffy white; metasomal terga two to five with several thin rows of long, rather stout, posteriorly directed hairs just basad of fasciae, all terga otherwise covered evenly with shorter thin whitish hairs; subapical fringes of short hair on metasomal sterna two to three distinct, recurved, most prominent on sternum two; both apical and subapical fringes of sternum four present, dense, the subapical densest medially and laterally; middle femur bare and shining beneath medially (or with a few short bristles posteromedially); front femur beneath rather evenly and sparsely covered with microscopic setae, heaviest basally and along anterior margin.

Punctuation: That of clypeus moderately close and coarse, that of vertex coarser and sparser except behind ocelli; punctures of mesoscutum coarser than those of vertex (sometimes only slightly so), and about as close (or mesoscutal punctures closer than those of vertex); punctures of mesoscutellum of uniform size and distribution, slightly smaller than those of mesoscutum; posterior surface of propodeum as described for *boharti*; punctuation of first two metasomal terga moderately close and coarse (punctures of basal half of first sparser), punctures of third and fourth almost alike, slightly finer

* Except as otherwise noted, this description is based upon a specimen (lectallotype, designated below) of the original type series kindly lent to me by Dr. Harold Grant of the Academy of Natural Sciences of Philadelphia. Statements of variation in parentheses are based upon other material of the subspecies.

and closer than those of second, terga otherwise punctate throughout; middle femur impunctate and polished beneath except for a few punctures basally; all punctured surfaces with a medium polish.

Structure: Apical margin of clypeus with a wide, shallow, weakly emarginate process about seven times as wide as high, resembling that of *triangulifera* but more prominent (fig. 3, H); antenna with first flagellar segment about $\frac{1}{11}$ as long as the second, segments two to ten equal in length, about .39 mm. each, apical (11th) segment longer, about .58 mm.; face only slightly wider than long, appearing almost round, ratio of length to width 1:1.10 (1:1.05-1:1.10); eye about as wide as genal area behind it; labial palpus as described for *N. boharti*; anterior lateral portion of prothorax smooth and shining except for a few scattered punctures; tegula with posterolateral angle rather evenly rounded, not abruptly bent; horizontal rugose basal area of propodeum crescent shaped; posterodorsal angle of propodeum moderately rounded, not as angulate as those described for *boharti*; transverse basal constrictions of first three metasomal terga as described for *N. boharti*, but more shallow; hind trochanter quadrate, possessing a single conspicuous nodule on its inner apex; hind femur keeled but not distinctly carinate basally along anteroventral and posteroventral angles (or keeled along anteroventral angle and feebly carinate along posteroventral angle); hind tibia broadly expanded apically, width at apex, including distal inner tooth, much more than half the length of the segment, distal tooth only slightly subapical; anterior inner margin of hind tibia with a broad, curved, median excavation whose proximal margin becomes sharply angulate, hind tibia thus appearing to be two-toothed (fig. 4, G, H); fourth metasomal sternum always with a pair of distinct sutures which converge apically to form a median triangular area; tubercles of fifth sternum of moderate size, nodulate, reticulated, pubescent (fig. 4, C); apex of gonostylus as seen in ventral aspect tapering and rounded (fig. 3, C); ventral process of gonostylus long, about .65 mm.; ratio of length of ventral process of gonostylus to length of gonostylus 1:1.6; subapical ventral margin of gonostylus with two to four rather indistinct bristles; laterodistal process of penis valve falcate.

Description of female: *

Size: Length 11.3 mm. (measured from a specimen from Fairbanks Springs, Nevada); length of forewing 9.7 mm. (9.7-9.9); width of face 3.1 mm. (3.1-3.2); length of face 2.7 mm. (2.7-2.9).

* This description, like that of the male, is based upon a specimen of the original type series.

Color: Head fuscous, lightest along clypeal margin (or head black, clypeus and supraclypeals largely fulvous); antennal scape fulvous, clavola fuscous, becoming lighter beneath; mesosoma fulvous, becoming somewhat fuscous anteriorly (mesosoma entirely fulvous to mesosoma fulvous but for black mesoscutum); metasoma entirely fulvous; legs entirely fulvous; tegula translucent-testaceous; wings pale brownish-hyaline, nervures and stigma yellow-brown to dark brown.

Pubescence: (Described from Fairbanks Springs specimens as in male.) Pale throughout; hairs of face, sides and venter of mesosoma buffy white, those of mesoscutum ochraceous-white, short and rather dense; fasciae of metasomal terga one to four buffy white to ochraceous-white, apical fringe of tergum five rufescent; stiff, posteriorly directed hairs just basad of fasciae on terga one to four colored as fasciae or with a pale yellow tinge, discs of metasomal terga one to five covered with short, feathery-plumose, appressed hairs interspersed with suberect short hairs, the former most prominent on terga three and four, present only apically on the first tergum; apical one third of metasomal sterna two to five with long, ochraceous-white hairs, those of sterna four and five with a golden or rufous tinge at their bases; scopa buffy white, hairs along posterior margin of hind tibia buffy white; hairs on outer side of middle tibia buffy white or with a tinge of gold.

Punctuation: That of clypeus very coarse and rather sparse, that of vertex finer and closer, especially behind ocelli; punctures of mesoscutum like those of vertex but closer, those of mesoscutellum like those of mesoscutum, almost evenly distributed; metasomal terga punctate throughout, first with moderately fine and rather close punctures, those of second as close but distinctly finer, those of third still finer and a little closer than those of second, those of fourth yet finer and about as close as those of third; middle femur beneath with sparse, coarse punctures basally and posteriorly, bare and shining medially and apically; front femur beneath coarsely and evenly covered with minute punctures.

Structure: Face a little wider than that of male and shorter, ratio of length to width 1:1.125 (1:1.117-1:1.132); clypeus long, hiding mandibles when the latter are fully retracted; apical margin of clypeus with a wide, very shallow, median process, the margin of which is sinuate (superficially appearing bidentate in some), of this

process indistinct or absent; genal area slightly wider than eye; first three metasomal terga only shallowly constricted, areas immediately posterior to constrictions not prominently raised.

Variation: The specimens from eastern Nevada are slightly smaller than the Fairbanks Springs group and, in general, somewhat more darkly colored. In these respects, they resemble the nearby Utah populations, and it is probable that the area of the Nevada-Utah line is a zone of intergradation between *N. nevadensis nevadensis* and *N. nevadensis arizonensis*. The group from Fairbanks Springs appears to be isolated by Death Valley and mountains from populations to the west and south.

Distribution: Known only from Fairbanks Springs, Nye Co., Nevada, and from White Pine Co., Nevada.

Type locality: Cresson, in the description of the species, gives the following information regarding type locality: "8 male, female specimens, Eastern Nevada, 1872. H. C. Yarrow."

Dr. Yarrow, in his account (Wheeler, 1875) of the 1872 expedition on which the above specimens were collected, writes: "Lieutenant Hoxie's route was from Fairfield, Utah, making a detour westward to Fillmore, Utah . . ., and following quite closely the outward course of Captain Simpson in 1858 and 1859, the southern limit of the so-called American Desert was crossed, the extreme western limit reached being Schell Creek Valley, Nevada. From this point, the direction was south by east to Snake Creek Valley, due east across Confusion Range, . . . south to the crossing of the Sevier, a short distance above Deseret City, and thence to Fillmore." The above narrative leaves no doubt that the type specimens were collected in either White Pine County, Nevada, or in the extreme western portion of Millard County, Utah. It seems most likely that the former is correct, and that the specimens actually came from the vicinity of what is now McGill, Nevada.

Type repositories: Lectotype female, designated by Cresson (1916), and lectallotype male, here designated, as well as one male paratype are in the Academy of Natural Sciences of Philadelphia.

Specimens examined: NEVADA: Nye County; Fairbanks Springs, June 21, 1949 (C. B. & R. N. Phillip), 1 ♂, 1 ♀; same locality, June 23, 1951 (I. LaRivers, T. Frantz), 1 ♂, 3 ♀.

Nomia (Epinomia) nevadensis arizonensis Cockerell

(Figs. 2; 3L)

Nomia arizonensis Cockerell, 1899, Entomologist, vol. 32, p. 128.*Nomia nevadensis arizonensis* Cockerell, 1925, Pan-Pac. Ent., vol. 1, p. 179.

Description: As described for *N. nevadensis nevadensis* except as follows:

Smaller, width of face of male 2.41-3.10 mm. (average approximately 2.75), of female 2.55-3.13 mm. (average approximately 2.86); color varying, sometimes wholly black but usually ranging from head and mesosoma black, metasoma black but for two basal fulvous segments, to color as described for *N. n. nevadensis*; wings of female hyaline-yellow to darkly infusate; pubescence of mesonotum, fasciae and sterna of females white to rufescent; appressed hairs on discs of terga one to five of female absent or very sparse; face short, clypeus not almost covering folded mandibles, average ratio of facial length to facial width of male 1:1.17, of female 1:1.25.

This form is easily distinguished from *N. n. bakeri* by its smaller size, more coarse and sparse punctation, and by the shape of the rugose propodeal base, which is narrowly crescent-shaped. Moreover, in areas where the two might be confused, *arizonensis* is usually mostly red, whereas *bakeri* is usually mostly black. *N. n. arizonensis* is separated from *N. n. stellata* by the absence of appressed tergal pubescence in the female of the former, and by the sharp proximal tooth of the male hind tibia. The black specimens are difficult to distinguish from *N. n. angelesia*, their smaller size being the best criterion.

Variation: Cockerell (1899, 1910) applied the species name *arizonensis* to a series of wholly black specimens labelled "Tucson, Arizona" or "Arizona." The same author (1925) reclassified the form as a black subspecies of *N. nevadensis*. Since forms with varying amounts of red as well as wholly black forms are recorded from the same localities over a wide area (and are, in fact usually predominant over the black forms), there seems to be little reason for restricting the name to the black specimens alone. It might be supposed that the different color forms are sympatric species, but the evidence does not support such a conclusion.

The fact that an almost complete series of intergrades exists between black and red indicates that interbreeding probably occurs. Moreover, all attempts to separate red from black forms by morpho-

logical differences, by host plants visited, and by seasons of activity have been unsuccessful. A difference of means test, using the width of face measurement was applied to red and black females from Tucson, Arizona, and Blythe, California. In both localities, results showed no significant differences between the two color forms ($P > .05$) indicating that in each locality, they are members of a single population on the basis of the character tested. Further evidence concerning the status of these color forms is found at their nesting sites. In 1951, Dr. G. E. Bohart and the author found black and partially red bees nesting together in a site near Delta, Utah, and this same observation has been reported separately by Dr. E. G. Linsley (in litt.) for a population at Blythe, California, and by Dr. G. D. Butler (in litt.) at Roll, Arizona. On the basis of the above facts, there is little doubt that the color forms represent normal components of certain populations and that their taxonomic separation is neither natural nor desirable.

N. nevadensis arizonensis, as herein defined, includes several geographically recognizable forms. It is felt that no useful purpose would be served by their taxonomic recognition, since these forms grade imperceptibly into one another. The details of this geographic variation will be presented elsewhere.

Distribution: *N. n. arizonensis* ranges over a large area from southeastern California to eastern New Mexico and from central Utah to northern Jalisco. It forms a wide zone of intergradation with populations of *N. n. angelesia* in southern California and also appears to intergrade with *N. n. stellata* in this region. It has not been found to intergrade with *N. n. bakeri* at any point along their adjoining ranges except in western Texas (see description of *N. n. bakeri*). *N. n. arizonensis* as defined within this paper has often been mistaken for *N. nevadensis nevadensis*, with which it intergrades along the Utah-Nevada border, but the two are separable on the basis of the characters described above.

Type locality: "Arizona."

Specimens examined: ARIZONA: Ajo, Arivaca, Arlington, Ashfork, Benson, Bill Williams Fork (Mohave Co.), Carr Canyon (Huachuca Mts.), Cochise Co., Continental, Dateland, Douglas, Eloy, Fredonia, Gila Bend, Harshaw, Marinette, McNeal, Oracle, Phoenix, Red Rock, Roll, Roosevelt Lake, Sabino Canyon, San Francisco Mts. (Coconino Co.), San Simon (Cochise Co.), Sentinel, Toltec, Tombstone, Tucson, Winslow, Yuma. NEW MEXICO: Albuquerque, Bernalillo, Carlsbad, Columbus, Glenwood, Laguna, La Luz, Las

Cruces, Malaga, Mesilla Park, Portales, Roswell, Santa Fe, Santa Rosa. TEXAS: Alpine, Cornudas (Hudspeth Co.), El Paso, Ft. Hancock, Marathon, Salt Flat (Hudspeth Co.). UTAH: Delta, Jericho, Lynndyl. AGUAS CALIENTES: Rincón de Romos. CHIHUAHUA: Chihuahua, Jiménez, Parral, Samalayuca, Santa Bárbara, Villa Ahumada. COAHUILA: Cabos, Guadalupe. DURANGO: 8 mi. So. Canutillo, Durango, Nombre de Dios, San Juan del Río. JALISCO: San Juan de los Lagos. ZACATECAS: Sain Alto.

Total number of specimens examined: 201 males, 277 females. The majority of these were taken between July 15 and Aug. 21. Males have been reported as early as May 6 and females as late as Sept. 22.

Flower records: *Asclepias* spp., 1 ♀; *Baccharis glutinosa*, 6 ♀; *Chrysothamnus* spp., 1 ♀; *Cleome serrulata*, 1 ♂; *Eriogonum* spp., 1 ♀; *Euphorbia* spp., 1 ♂, 1 ♀; *Eysenhardtia polystachya*, 2 ♂, 1 ♀; *Grindelia squarrosa*, 3 ♂, 40 ♀; *Grindelia* spp., *Guardiola tulocarpa*, 5 ♂, 3 ♀; *Gutierrezia* spp., 1 ♀; *Haplopappus spinulosus*, 5 ♀; *Helianthus* spp., 2 ♂; *Hymenothrix wislizeni*, 1 ♀; *Hymenoxys* spp., 3 ♀; *Isocoma heterophylla*, 1 ♂; *Lygodesmia juncea*, 1 ♂, 2 ♀; *Pectis papposa*, 3 ♂, 5 ♀; *Psilotrophe cooperi*, 1 ♀; *Solanum elaeagnifolium*, 4 ♂; *Solanum* spp., 1 ♂; *Sphaeralcea* spp., 1 ♂; *Verbesina* spp., 2 ♂; *Wislizenia refracta*, 1 ♀.

Nomia (Epinomia) nevadensis angelesia Cockerell

(Fig. 2)

Nomia arizonensis angelesia Cockerell, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 293.

Nomia nevadensis angelesia Cockerell, 1925, Pan-Pac. Ent., vol. 1, p. 179.

Description: As described for *N. nevadensis nevadensis* except as follows:

Width of face of male 2.62-3.30 mm. (average approximately 2.99), of female 2.79-3.37 (average 3.10); color wholly black, wings honey brown, moderately infuscated; pubescence of mesonotum long, buffy white, that of fasciae and sternal hairs also buffy white; appressed hairs on discs of terga one to five of female absent or very sparse; face short, clypeus not almost covering folded mandibles, average ratio of facial width of male 1:1.17, of female 1:1.23.

This subspecies is separable from the red forms of *nevadensis arizonensis* by color and by its larger size and longer mesonotal pubescence. It is difficult to distinguish from black forms of the latter in the more southern parts of its range, but is larger than

arizonensis in the more northern parts of its range. It differs from *N. n. stellata* by being larger, by the absence of appressed tergal pubescence in the female, and by the presence of a sharp median tooth on the hind tibia of the male.

Distribution: *N. n. angelesia* is found from southern Oregon to the northern coast of Baja California, and east to west central Nevada and south central California. There is a wide zone of intergradation with *arizonensis* in the latter area, but no intergrades with *stellata* have been found.

Type locality: Los Angeles County, California.

Specimens examined: CALIFORNIA: Antioch, Berkeley, Blythe, Coachella, Davis, Dos Palos, Dulzura, Firebaugh, Hagerman Park, Helendale (San Bernardino Co.), Hemet, Hot Creek (Mono Co.), Imperial Co., Indio, Jacumba, Kane Springs (Imperial Co.), Los Angeles, Mammoth Lakes (Mono Co.), Mendota, Newport Beach (Orange Co.), Oakley, Palo Verde, Rialto, Rio Vista, Riverside, Sacramento, San Diego, San Diego Co., San Jacinto, Tulare, Turlock, Vina, Yucca Valley. NEVADA: Walker Lake (Mineral Co.). OREGON: Diamond Lake (Douglas Co.). BAJA CALIFORNIA: 35 mi. south of Tijuana.

Total number of specimens examined: 205 males, 194 females. The majority of these specimens were taken between July 10 and Aug. 28. Throughout the range of the form, however, the flight season is long (April 20-Oct. 26) and it seems probable that there is commonly more than one generation per year.

Flower records: *Aster spinosa*, 3 ♀; *Brassica* spp., 2 ♂; *Centromadia pungens*, 6 ♂, 6 ♀; *Chrysothamnus* spp., 1 ♂; Compositae (no further data given), 24 ♂; *Croton californicus*, 4 ♂; Cruciferae (no further data given), 3 ♂; *Grindelia camporum*, 1 ♀; *Grindelia* spp., 2 ♂, 10 ♀; *Gutierrezia sarothrae*, 7 ♂, 13 ♀; *Heterotheca grandiflora*, 3 ♀; *Isocoma* spp., 2 ♀; *Lotus americana*, 4 ♂; *Medicago sativa*, 8 ♂; *Melilotus alba*, 11 ♂, 2 ♀; *Melilotus* spp., 11 ♂, 5 ♀; *Pectis papposa*, 4 ♂, 19 ♀; *Solidago occidentalis*, 1 ♂; *Solidago* spp., 3 ♂, 22 ♀; *Tamarix gallica*, 1 ♂, 1 ♀; *Trichostema* spp., 1 ♀; *Wislizenia refracta*, 1 ♂.

Nomia (Epinomia) nevadensis stellata, subsp. nov.

(Figs. 2; 4G)

Description: As described for *N. n. nevadensis* except as follows:

Male: Smaller, width of face 2.82 mm. (2.45-2.82); color wholly black (to head and mesosoma black, two basal metasomal segments fulvo-ferruginous); wings hyaline-brown; median excavation of hind tibia shallow (fig. 4, G), prominence formed by its proximal margin

rounded rather than angulate (or excavation deeper, prominence angulate); under surfaces of middle and hind tibiae shallowly undulate (or smooth); face shorter, clypeus not almost covering folded mandibles, average ratio of facial length to facial width 1:1.16.

Female: Smaller, width of face 2.79 mm. (2.55-2.89); head, mesosoma, legs, and lateral portions of metasomal terga black, discs of metasomal terga dull fulvo-ferruginous (or wholly black); wings hyaline-brown; pubescence of mesonotum and fasciae pale buffy white; discs of metasomal terga more densely covered with short, plumose, appressed hairs, most prominent on terga three and four, stiff, posteriorly directed hairs basad of fasciae inconspicuous; long hairs of sterna two to five uniformly buffy white; posterior margin of horizontal rugose base of propodeum carinate (or this carina lacking); face short, clypeus not almost covering folded mandibles, average ratio of facial length to facial width approximately 1:1.22.

N. n. stellata differs from *N. n. angelesia* in being smaller with much lighter wings. It may be separated from *N. n. arizonensis*, as well as from *angelesia* by the presence of the appressed pubescence on the metasomal terga, the carinate posterior margin of the propodeal base in the female, and by the absence of the sharp median tooth on the hind tibia of the male (fig. 4, G).

Variation: Due, perhaps, to its occurrence on a narrow peninsula, this form shows a wide range of intrapopulational variation. Males overlap in every key character with those of *arizonensis* and are only partially separable from that form. Females are distinct from those of surrounding subspecies. Moreover, marked differences in color occur between the sexes, males usually being wholly black while females often possess one or more red terga.

Since the males can be referred to adjoining forms, the author has preferred to designate this form as a subspecies, being aware that later research may prove it to be a distinct species.

Distribution: Middle Baja California north to the southern portions of California. Male specimens from Imperial Co., California, were examined which are believed to be intergrades between this form and *N. n. arizonensis*. No evidence of intergradation with *N. n. angelesia* in northwestern Baja California has been found.

Type material: Holotype male, allotype female, ten male and ten female paratypes from San Pedro, Baja California, Oct. 4, 1941 (E. S. Ross, G. E. Bohart).

Type repositories: Holotype, allotype, four male and four female paratypes in the California Academy of Sciences. One male and one female paratype in the Snow Entomological Museum.

Specimens examined: BAJA CALIFORNIA: 15 mi. So. San Domingo, Oct. 4, 1941 (E. S. Ross, G. E. Bohart), 2 ♂; San Pedro, Oct. 7, 1941 (E. S. Ross, G. E. Bohart), 13 ♂, 15 ♀, plus type material.

Nomia (Epinomia) nevadensis bakeri Cockerell

(Figs. 2; 3M)

Nomia bakeri Cockerell, 1898, Entomologist, vol. 31, p. 32.

Nomia pattoni Cockerell, 1910, Proc. U. S. Nat. Mus., vol. 38, p. 292.

Nomia nevadensis pattoni, Cockerell and Blair, 1930, Amer. Mus. Novitates, no. 433, pp. 14, 16.

Nomia bakeri var. *rufbasis* Cockerell, 1930. In Cockerell and Blair, Amer. Mus. Novitates, no. 433, p. 14.

Nomia nevadensis bakeri, Cockerell and Blair, 1930, Amer. Mus. Novitates, no. 433, pp. 7, 14, 16.

Description: As described for *N. n. nevadensis* except as follows:

Male: Width of face 2.41-3.13 mm. (average approximately 2.99 mm.); color varying, rarely as described for *N. n. nevadensis*, usually ranging from wholly black to head and mesosoma black, metasoma black but for two ferruginous basal segments; apex of hind femur usually black, remaining segments of leg fulvous; wings honey brown to moderately infuscated; punctures of vertex finer and closer than those of clypeus, punctation finer and closer throughout than that described for *N. n. nevadensis*; horizontal rugose base of propodeum widely crescent shaped or appearing truncate posteriorly; face shorter than that described for *nevadensis*, clypeus not almost covering folded mandibles, average ratio of facial length to facial width, 1:1.17.

Female: Width of face 2.75-3.30 mm. (average approximately 3.06 mm.); color as described for male; wings moderately to heavily infuscated; pubescence of mesonotum white to buffy white; hairs of metasomal sterna buffy white; appressed hairs on discs of terga one to five absent, stiff, posteriorly directed hairs basad of fasciae inconspicuous; punctures of first and second metasomal terga nearly alike, punctation finer and closer throughout than that described for *N. n. nevadensis*; rugose propodeal base as described above for male; face short, clypeus not almost covering mandibles, average ratio of facial length to facial width 1:1.28.

This subspecies is easily distinguishable from *N. n. arizonensis* by its larger size, finer and closer punctation, and by the widely crescentic or truncate configuration of the rugose propodeal base. In areas where the two meet, *bakeri* is usually wholly or largely black while *arizonensis* usually possesses at least two fulvous metasomal segments.

Variation: *N. n. bakeri* is usually readily separable from all other subspecies of *N. nevadensis* on the basis of the characters given

above, and was considered as a distinct species until Cockerell and Blair (1930) placed it under *N. nevadensis* because of similarities in the male genitalia of the two forms.

Despite the differences mentioned in the description, the genitalia and hind tibiae of the males agree with those of *N. n. arizonensis*, which it neighbors to the east. These two characters have been especially useful in separating the species of *Epinomia*. Moreover, neither the size nor color differences between *bakeri* and other subspecies of *nevadensis* are extraordinary. The largest *bakeri* are no larger than northern California specimens of *N. n. angelesia*, and in the southern part of its range, fulvous *bakeri* are found which closely resemble other red forms of the species.

As stated previously, *N. n. bakeri* geographically replaces *arizonensis* to the east. However, the status of these bees where their ranges meet is obscure and requires further investigation. Cockerell (1930) thought of *bakeri* only as a plains bee and suggested that it might intergrade with *arizonensis* in southeastern Colorado. Because specimens from this area were not available for purposes of the present paper, the truth of this surmise is still untested. A single typical specimen of *bakeri* from each of two localities in western Colorado (Durango and Leadville) indicates, however, that this form is established west of the Rocky Mountains. Since typical *arizonensis* is known from Albuquerque, if intergradation does take place in this area, it must occur between the latter locality and Durango. Along the eastern border of New Mexico, there is evidence suggesting that the two ranges overlap. A single small male *bakeri* from Tucumcari, New Mexico, has been examined, and a single typical male *arizonensis* is known from Portales, New Mexico, southwest of Tucumcari.

From Barstow, Ward County, Texas, however, comes a series of fulvous bees which seem to be intergrades between the two forms. On the basis of this evidence, *bakeri* is placed as a subspecies of *nevadensis*. It is clear, however, that more study and material is needed before the status of these forms is settled.

Distribution: Northern Florida to south central Wyoming, the eastern two thirds of Colorado, and the extreme northern and eastern portions of New Mexico south to near Barstow, Texas, thence southeast to the gulf coast near Matamoros, Tamaulipas.

Type locality: "Colorado."

Specimens examined: ALABAMA: Selma. COLORADO: Berkeley, Boulder, Canfield, Crook, Crowley, Denver, Durango, Ft. Lupton, La Junta, Lamar, Leadville, Limon, Logan Co., Roggen, Sterling,

White Rock, Valmont. FLORIDA: Flagler Beach. KANSAS: Douglas Co., Garden City, Hutchinson, Lakin, Newton, Pawnee Co., Piercerville, St. John, Stafford. LOUISIANA: Tallulah. MISSISSIPPI: Hattiesburg. NEBRASKA: Mitchell. NEW MEXICO: Tucumcari. TEXAS: Barstow, Bishop, Conlen, Cotulla, Dalhart, Dilley. WYOMING: Guernsey, Lingle. TAMAULIPAS: Matamoros.

Total number of specimens examined: 110 males, 232 females. The majority of these were taken between July 21 and Aug. 30. Males have been taken as early as April 17 and females as late as Oct. 15. There are probably several generations per year in the southern portions of the range.

Flower Records: *Bidens involucrata*, 3 ♂; *Boltonia asteroides*, 2 ♂; *Chrysopsis microcephala*, 2 ♀; *Chrysopsis* spp., 1 ♀; *Coreopsis* spp., 3 ♂, 1 ♀; *Dalea lanata*, 2 ♂; *Grindelia* spp., 5 ♂; *Heterothea* spp., 2 ♂, 42 ♀; *Isopappus* sp., 2 ♂, 15 ♂; *Melilotus alba*, 8 ♂, 1 ♀; *Prionopsis* spp., 2 ♀; *Prosopis* spp., 2 ♀; *Solidago* spp., 3 ♀; *Thelesperma gracile*, 1 ♂; *Verbesina* spp., 1 ♂.

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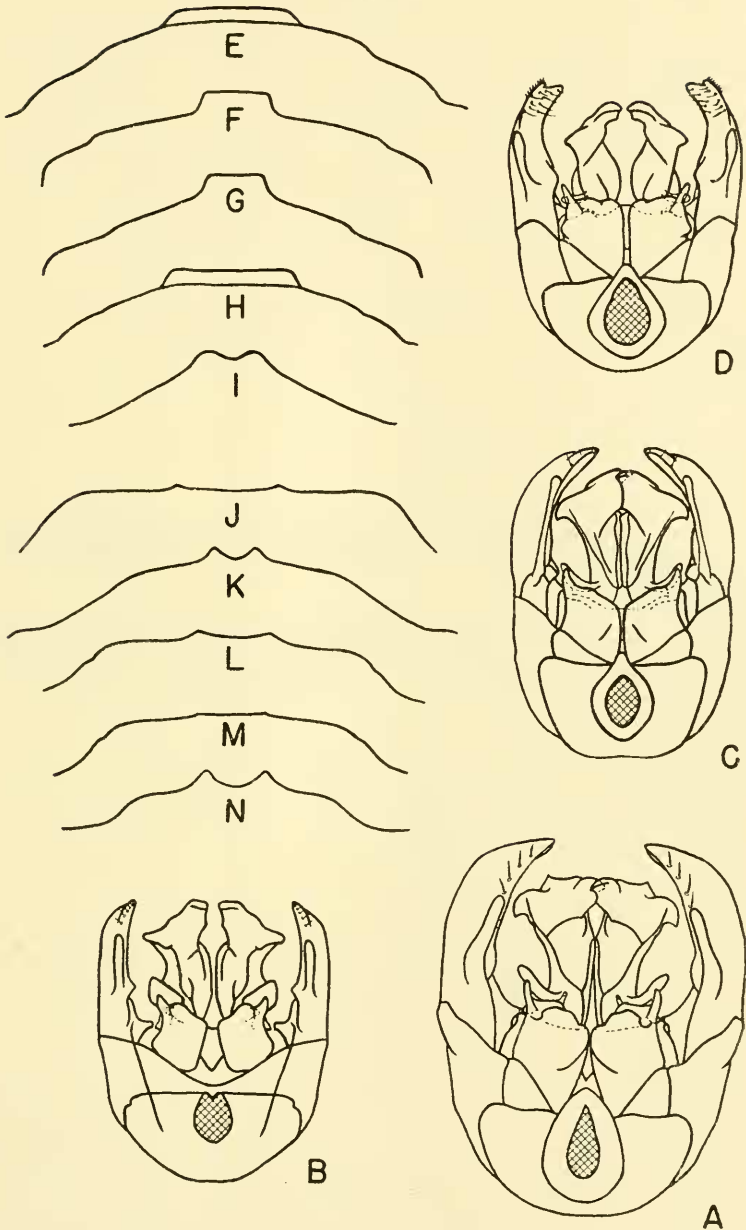
A-D. Genital capsules of *Epinomia*, ventral aspect.

A. *N. triangulifera* (Amazonia, Mo.); B. *N. micheneri* (Carr Canyon, Ariz., paratype); C. *N. nevadensis nevadensis* (Fairbanks Springs, Nev.); D. *N. boharti* (paratype).

E.-N. Clypeal margins of *Epinomia* as seen from beneath.

E. *N. triangulifera*, male (Douglas Co., Kans.); F. *N. micheneri* (holotype); G. *N. micheneri* (Carr Canyon, Ariz.), (male paratype); H. *N. nevadensis nevadensis*, male (Fairbanks Springs, Nev.); I. *N. boharti* (male paratype); J. *N. triangulifera*, female (Lawrence, Kans.); K. *N. micheneri* (allotype); L. *N. nevadensis arizonensis*, female (Delta, Utah); M. *N. nevadensis bakeri*, female (La Junta, Colo.); N. *N. boharti*, female (San Blas, Nayarit).

FIG. 3



A-D. Sterna five of male *Epinomia*.

A. *N. triangulifera* (Lawrence, Kans.); B. *N. micheneri* (Sta. Bárbara, Chihuahua); C. *N. nevadensis nevadensis* (Fairbanks Springs, Nev.); D. *N. boharti* (paratype).

E-I. Right hind tibiae of male *Epinomia*.

E. *N. triangulifera* (Promontory, Utah); F. *N. micheneri* (holotype); G. *N. nevadensis stellata* (paratype); H. *N. nevadensis nevadensis* (lectotype); I. *N. boharti* (paratype).

FIG. 4

